We face risk



Changing risks

12th Asia-Oceania Group on Earth Observations (AOGEO) Symposium

Canberra, Australia on 2nd – 4th November 2019

Increasingly complex and unpredictable risks



Department of Meteorology Sri Lanka

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To protect life and property from natural disasters such as floods, landslides,, storms, etc.

Development of a <u>Numerical Weather Prediction</u> system

Based on physical lows Beyond several hours

Accurate prediction of timing and location of severe weather events Accurate prediction of typhoon tracks

Development of a <u>Nowcast</u> system

Based on a heuristic method

Up to a few hours

Accurate prediction of timing and location of precipitation

Global Observing System

SURFACE OBSERVING SYSTEM (Observations from land stations and ships)



SURFACE OBSERVING SYSTEM (Observations from buoys)



UPPER-AIR OBSERVING SYSTEM (Observations from upper-air stations)



Space segment of GOS



UPPER-AIR OBSERVING SYSTEM (Observations from aircraft)



Other observation platforms

- Doppler radars
- solar radiation observations
- lightning detection measurements
- tide-gauge measurements

FLOW OF INFORMATION

The World Weather Watch consists of observing systems, telecommunication facilities, and dataprocessing and forecasting centres - owned and run by WMO Members countries - to generate and distribute meteorological and related geophysical observations, forecasts and early warnings



Data, forecasts, warnings are the WWW outputs for Natural Disaster Prevention and Mitigation



Observation and Data Collection

Surface & Upper Air Observations



Radiosondes/ radar



Manual observations



AWS



Pilot balloon



Aircraft observations



Ship observations



Fixed/drifting buoys



Satellite Products

Current Operational Numerical Models



WRFDA (5X5 km)



Study model forecasts (eg: <u>Stormsurf</u>, <u>Earth nullsclool</u>, <u>India meteorological</u> <u>website</u>, <u>INCOIS</u> etc.)

Initialized: 18ZSun24JAN2016

Wind forecast models











+66hr Forecast

Rainfall forecast

ECWMF model – extreme weather forecast

Wind speed



(Background does not depict political boundary)





Precipitation

Thursday 28 January 2016 12UTC CECMWF Extreme forecast index t+012-036 VT: Friday 29 January 2016 00UTC - Saturday 30 January 2016 00UTC Surface: 10 metre wind gust index



Wind gust

Total precipitable water



Numerical Weather Predictions (NWP)

WRFDA(5KM) Rainfall(mm) valid 03UTC 24/01/2016 (24Hours)



Analyze satellite images (eg: <u>Himawari 8</u>,FY2G, <u>ASCAT</u>, ect.)





Maddern - Jullian Oscillation monitoring



12_Hours RainFall(Region)_12Z25JAN2016



National Meteorological Centers

The NMCs prepare:

*Forecasting

- Weather forecasting, advisory and warning issue and Tsunami monitoring
- Marine forecasting
- Numerical weather prediction
- Now casts and very short-range forecasts ?
- Short, medium, extended- and long-range forecasts based on products received from WMCs and RSMCentres, or by integrating regional models using boundary conditions based on these products;
- Special application-user products, including warnings of severe weather, climate and environmental quality monitoring and prediction products;
- *Non-real-time climate-related analyses and diagnosis



Responding to User Requirements: Forecast of Various Timescales



DEVELOPMENT OF FORECAST OF DIFFERENT TIMESCALES IN SRI LANKA BASED ON STAKEHODER DEMANDS

Analyze synoptic data , Study model forecasts, Rainfall forecast, ECWMF model – extreme weather forecast,Total precipitable water, Analyze satellite images (eg: <u>Himawari 8</u>,FY2G, <u>ASCAT</u>, ect.), Numerical Weather Predictions (NWP)

ENHANCEMENTS IN SPATIAL RESOLUTION WERE ALSO INTRODUCED BY DOM; FORECAST FOR SPECIFIC SECTORS EVOLVED

Where We Are Now? (Department of Meteorology)



Our target is to achieve theses two for better service for general public and different sectors to contribute economy of Sri Lanka



To minimize the hazards

Next 6 hours (Very Short Range Weather Forecast)
Next 1 hour to 3 hour (Now-casting)

To prepare Weather Forecast in above time scales

- Doppler Weather Radar
- Dense AWS network
- □ Analyze satellite images data (eg: <u>Himawari 8</u>,FY2G, <u>ASCAT</u>, ect.),

We need help from ICHARM

- □ Speed Data Communication Technology
- □ Latest technology with instruments
- □ High speed computers
- □ More sophisticated, accurate and reliable Climate data Measuring instrument
- □ Mathematical and Scientific knowledge about Atmosphere and its motion

Roadmap/Strategic way for Global Agenda

Important for better Public Weather Service (PWS) / Early Warnings for DRR

DEPARTMENT OF METEOROLOGY - SRI LANKA



Source : WMO

Three important global agreements Sri Lanka has recently committed to

Sendai Framework for Disaster Risk Reduction

At the 3rd UN World Conference on DRR in March 2015 countries adopted the SFDRR, a 15-year, voluntary, non-binding agreement that aims for the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

Sustainable Development Goals

In September 2015, countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda.

UNFCCC/Paris Agreement

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate agreement. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to below 2° C.

Challenges and Gaps

Integrated Forecasting System

Output from different meteorological observation systems, numerical weather products, satellite imagery and forecast tools are analyzed separately in arriving at the weather forecast.

Accuracy of the forecast can be improved by developing an integrated forecasting system

Data Collection, Quality Control and Archival system

Meteorological/climatological processing and archival system based on personal computer environment is based on WMO supported CLICOM and CLIMSOFT database management systems.

Public Weather Service

Public Weather Service is to strengthen the capacity and skill to meet the needs of the users through delivery of comprehensive weather services.

Necessary to establish a public weather service system capable of delivering the user required services.

<u>User Services for Major sectors</u>

Quality of meteorological data and forecast is crucial to ensure the safety of flights.

To enhance the services provided to aviation sector a pilot briefing system with direct web based access is required to be installed at Katunayake International Airport

DoM need correct Now casting of Precipitation method





• Urban flood caused by a rapidly developing rain cloud

proposed weather radar network system



DOM Puttalam Observatory (Puttalam Radar Observation Station) DOM Pottuvil **DOM** Aviation Observatory Meteorological Office (Pottuvil Radar servation Station the Colombo International Airp National Meteorological Centr (NMC) at DOM He Office **DOM Aviation** eteorological Office in the Mattala Rajapaksa International Airport

Government of Japan: **Two Billion Five** Hundred and Three Source Million Japanese Yen Finance (JPY 2,503,000,000) Government of Sri Lanka: 486,650,000 Rupee



of

Signed date: June 30, 2017 Duration: December 31, 2023

Doppler Radar Project (Grant Aid Project by Japanese Govt)

Department of Meteorology need Meteorological data Network Integration system





Meteorological Data Visualization and Forecast Production System

(Smart Met for Public Weather and Early Warning Services)





DOM need Weather Information and Forecast Production System



mobile weather application, data produced with Smart Met and warning information with Smart Alert

Overview of Observation Network Manager



Proposal of Capacity Development

- Action has been taken to Implementation of Modernization Project of the Department of Meteorology with the assistance of World Bank
- Need training of officials especially Young Meteorology to train on forecasting including:
- ✓ Numerical Weather Prediction
- \checkmark Forecast verification theory & basics
- ✓ Radar Meteorology & satellite imagery and forecast tools are analyzed separately in arriving at the weather forecast.
- ✓ Public Weather and Early Warning Service training
- Gauges fixed by ICHARM also to be linked with Cres MP assisted by World Bank
- DOM wanted to collaborate with ICHARM



Thank you